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NORTHERN FOREST RESEARCH CENTRE (CANADA). PROGRAM REVIEW

# Program Review 1982-83

## Northern Forest Research Centre

# PROGRAM REVIEW 1982-83

NORTHERN FOREST RESEARCH CENTRE
CANADIAN FORESTRY SERVICE
ENVIRONMENT CANADA
1983

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## THE CANADIAN FORESTRY SERVICE
## ENVIRONMENT CANADA

The Canadian Forestry Service (CFS) is the principal source of federal expertise in forestry. Its general objective is to promote the wise management and use of Canada's forest resources for the economic, social, and environmental benefit of Canadians.

The following are the main functions of the CFS:

1. providing coordinated federal policies to promote forest industry development and better resource management;

2. providing scientific and technical leadership through research and development;

3. providing and analyzing national and international information and statistics as a basis for policy;

4. aiding in developing and certifying codes and standards of product performance;

5. protecting Canada's forests from foreign pests;

6. supporting provincial forest renewal programs to ensure permanent viability of the forest resource;

7. fostering the potential use of the forest resource for energy; and

8. contributing to the environmental objectives of the Department of the Environment.

A number of federal agencies are involved in forestry programs, and a Federal Forestry Sector Strategy Committee has been established to coordinate federal forestry activities. The CFS has been designated the lead agency.

In September 1982 the Canadian Forestry Service assumed responsibility for regional economic development from a forestry standpoint. In this context the service is required to negotiate federal-provincial forest renewal agreements of intensive forest management practices to meet the objective of the federal forestry sector strategy. As a result, the CFS is also involved in the development of economic profiles and studies to identify regional and national needs and development opportunities.

The Canadian Forestry Service is composed of a headquarters unit, six forest research centers, and two national institutes. The forest research centers are responsive to regional priorities and maintain close liaison with the respective provincial government forestry departments. They also participate in, and frequently lead, national programs. The national institutes provide the focus for programs of national scope. The headquarters unit comprises three directorates: Research and Technical Services, which plans, directs, and coordinates the research and development programs and technical services of the CFS; Forestry Relations, Economics, and Development, which handles forestry relations with universities, industry, and other governments, economic analyses, as well as the

coordination of the forestry development and employment stimulation programs; and Finance, Planning, and Administration, which manages the support services of the CFS in planning and program evaluation, finance, administration, and human resources management.

**ENVIRONMENT CANADA**

## SERVICE CANADIEN DES FORETS
## ENVIRONNEMENT CANADA

Le Service canadien des forêts (SCF) réunit la majorité des spécialistes fédéraux en foresterie. Son objectif général est de promouvoir l'aménagement et l'utilisation judicieux des ressources forestières du Canada pour le plus grand bien économique, social et environnemental des Canadiens.

Voici les principales fonctions du SCF:

1. fournir des politiques fédérales coordonnées afin de favoriser l'expansion de l'industrie forestière et l'amélioration de la gestion des ressources;

2. fournir une orientation scientifique et technique par la recherche et le développement;

3. fournir et analyser l'information et les statistiques nationales et internationales qui serviront de base aux politiques;

4. aider à la mise au point èt à la certification des codes et des normes en matière de performance des produits;

5. protéger les forêts canadiennes en luttant contre les ravageurs étrangers;

6. appuyer les programmes provinciaux de régénération forestière afin d'assurer la viabilité permanente des ressources forestières;

7. parrainer l'utilisation éventuelle des ressources forestières pour la production d'énergie; et

8. adhérer aux objectifs environnementaux du ministère de l'Environnement.

Divers organismes fédéraux participent aux programmes forestiers, et un comité de la stratégie forestière fédérale a été créé pour coordonner les activités fédérales en matière de foresterie. Le SCF a été désigné organisme directeur.

Depuis septembre 1982, le SCF assume la responsabilité du développement économique régional dans le domaine forestier. A ce titre, il doit conclure des ententes fédérales-provinciales, relatives à la régénération forestière, sur des méthodes de gestion intensive des forêts afin d'atteindre les objectifs de la stratégie forestière du Canada. Le SCF doit conséquemment participer à la mise au point de profils et d'études économiques afin de cerner les besoins sur les plan régional et national, de même qu'aux possibilités de développement.

Le SCF comprend une administration centrale, six centres de recherches forestières et deux instituts nationaux. Les centres de recherches forestières doivent répondre aux impératifs régionaux et entretenir une liaison étroite avec les ministères provinciaux des Forêts. Ils participent également à des programmes nationaux dont ils assument fréquemment la direction. Les instituts nationaux sont les foyers des programmes d'envergure nationale.

L'Administration centrale comprend trois directions générales: Recherches et Services techniques, dont le rôle consiste à planifier, diriger et coordonner les programmes de recherche et développement ainsi que les services techniques du SCF; Relations, Economie et Développement, qui s'occupe des relations forestières avec les universités, l'industrie et les autres gouvernements, d'analyses économiques ainsi que de la coordination des programmes de développement forestier et de création d'emplois; et Finances, Planification et Administration, qui dirige les services de soutien du SCF dans la planification, l'évaluation des programmes, les finances, l'administration et la gestion du personnel.

**ENVIRONNEMENT CANADA**

**MINISTRE**

**Sous-ministre**

**Sous-ministre adjoint**
**Service canadien des forêts**

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et Développement

**Directeur général**
Recherches et
services techniques

**Directeur général**
Finances, Planification
et Administration

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Centre de recherches forestières du
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Victoria (Colombie-Britannique)

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Centre de recherches forestières du Nord
Edmonton (Alberta)

Directeur régional, Ontario
Centre de recherches forestières des
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Sault-Sainte-Marie (Ontario)

Directeur
Institute pour la répression des
ravageurs forestiers
Sault-Sainte-Marie (Ontario)

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des Laurentides
Sainte-Foy (Québec)

Directeur régional, Maritimes
Centre de recherches forestières
des Maritimes
Frédéricton (Nouveau-Brunswick)

Directeur régional, Terre-Neuve
et Labrador
Centre de recherches forestières
de Terre-Neuve
Saint-Jean (Terre-Neuve)

Directeur
Institute forestier national de
Petawawa
Chalk River (Ontario)

## CONTENTS


| | Page |
|---|---|
| **Director's Report** | 1 |
| **Environmental Forestry Research** | |
| NOR-7 Reduction of damage from pollutants in the atmosphere | 5 |
| NOR-13 Maintenance and improvement of water yield and quality | 5 |
| NOR-22 Remote sensing applications | 6 |
| NOR-23 Ecological land classification of national parks | 7 |
| NOR-28 Environmental impact assessments | 8 |
| NOR-31 Climatic studies | 8 |
| NOR-32 Reduction of damage from LRTAP and other atmospheric pollution | 9 |
| NOR-33 Scientific and technical information | 10 |
| NOR-34 Forest biomass as an energy source (ENFOR) | 11 |
| NOR-52 Analytical services | 12 |
| **Forest Resources Research** | |
| NOR-4 Yields of managed stands | 15 |
| NOR-5 Fire management systems and guidelines | 16 |
| NOR-10 Silvicultural investigations | 17 |
| NOR-12 Tree improvement | 18 |
| NOR-29 Forest resource data | 19 |
| NOR-53 Computing and data processing | 20 |
| **Forest Protection** | |
| NOR-1 Detection and appraisal of tree pests and vegetative disturbances | 23 |
| NOR-9 Forest insect and vegetation systems | 23 |
| NOR-17 Forestry services | 24 |
| NOR-35 Tree disease research | 25 |
| **Regional Development** | |
| NOR-3 Resource opportunities and policy guidelines | 29 |
| NOR-36 Forest resource development agreements with the prairie provinces and NWT | 29 |
| NOR-54 Support services (regional development) | 30 |
| **Administration** | |
| NOR-51 Financial, administrative, and support services | 31 |
| **Public Information** | 32 |
| **Appendixes** | |
| A - Organizational chart | 33 |
| B - Staff listing | 34 |
| C - Expenditures | 38 |
| D - Cost-shared agreements | 39 |
| E - Contracts let or supervised | 40 |
| F - Publications | 43 |

## DIRECTOR'S REPORT

The Northern Forest Research Centre (NoFRC), located in Edmonton, Alberta, is responsible for fulfilling the federal role in forestry research, development, and technology transfer in the three prairie provinces--Alberta, Saskatchewan, and Manitoba--and the Northwest Territories. This report on our programs reflects the progress made during the fiscal year 1982-83 in achieving work objectives.

Our research activities are organized under three programs: Environmental Forestry Research, Forest Resources Research, and Forest Protection. In late 1982 NoFRC assumed responsibility for the development and implementation of a new generation of federal-provincial forestry agreements in the three prairie provinces. These activities are being carried out under the newly established Regional Development Program. Administrative services and building maintenance personnel complete the total staff of 125, which is supported by an operating budget of about $7 million. During 1982-83 we continued to strengthen our program planning system by preparing an operational plan to guide program development during the 5-year period from 1983-84 to 1987-88.

A federal-provincial Memorandum of Understanding (MOU) Concerning the Coordination of Forest Research was signed with Alberta and with Manitoba. It is anticipated that a Canada-Saskatchewan MOU will be signed in 1983.

Achievements in our research and regional development programs during the 1982-83 fiscal year are outlined in the main body of the text; organization, staff listing, expenditures, cost-shared agreements, contracts, and publications are detailed in the appendixes (A to F). Program accomplishments are briefly highlighted in the following paragraphs.

### Environmental Forestry Research

Research on the effect of long-range transport of air pollutants and radionuclides from uranium mining and milling operations on forest systems was continued. Simulated acid rain misting experiments were initiated.

Studies concerning deposition and movement of sulfur from elemental sulfur blocks around sour gas plants in west-central Alberta were continued. Experiments were initiated to determine the effect of $SO_2$ concentration and duration of exposure on pollutant entry and metabolic response of jack pine. Studies on ecology of peatland development and characterization in north-central Manitoba were undertaken. Sixty-five sites were sampled in the Flin Flon-The Pas-Waboden area. Further progress was made on the climatic variation study, mainly through the completion of two contracts on dendroclimatology work. Final reports on ecological land classification of Banff and Jasper national parks were published. Fieldwork on ecological land classification of Kootenay National Park was completed. Further upgrading of the large-scale photosampling system for conversion from a research mode to an operational mode was undertaken; this would facilitate use in fixed- and rotary-wing aircraft.

The computerized Mapping and Analysis of Resources System was updated to Version-2 capabilities. Example forest inventory maps from each of the prairie provinces and Northwest Territories were digitized to demonstrate conversion of conventional forest inventories to biomass inventories.

Several ENFOR (ENergy from the FORest) contracts that involved over $300 000 were initiated or continued.

**Forest Resources Research**

A 10-day experimental burning project was conducted in the black spruce-lichen woodland fuel complex at Porter Lake, NWT, by NoFRC and other CFS fire research staff. The 10 experimental burns are in support of a national study being undertaken to establish fire behavior indexes in various forest cover types in connection with the further refinement of the Canadian Forest Fire Danger Rating System.

An intensive, short-term study to determine the effects of line clearing (i.e., seismic and pipe) on tree and stand growth in the commercial forest zone of western Alberta has been completed, and a final report was prepared. The final assessment of a major fertilization experiment on lodgepole pine has been completed; results indicate a substantial response in stem wood production 10 years after fertilization with nitrogen.

A report on *Silviculture statistics for Canada, 1975-80* was published and distributed. A new program on mechanization of silviculture was undertaken in 1982. Initial emphasis will be placed on developing a regional equipment inventory, with evaluation of site preparation to follow.

A 10-year remeasurement of the jack pine family test plantations in eastern Manitoba was carried out, and the best-performing 40 families will be used for establishing a seed orchard using grafted stock. Reports outlining progress to date on the jack pine breeding program for Manitoba and Saskatchewan have been published.

The computer and data processing service continues to operate near full capacity, with over 10 000 tasks per month being handled by the system that centers around the use of a PDP 11/60 minicomputer and an HP 1000 Resource Analysis and Mapping System.

**Forest Protection**

The mountain pine beetle outbreak continued to be the most important commercial forest pest problem in the region. Staff at NoFRC maintained close contact with Parks Canada and the Alberta Forest Service. Input was provided at several public meetings concerning the mountain pine beetle during 1982-83. Mortality on provincial crown land was estimated at 577 000 trees in 1982. This occurred within 350 individual patches over 4 300 ha of pine forests and amounted to a volume loss of approximately 190 000 $m^3$. Outbreaks were monitored in Kootenay National Park and Cypress Hills Provincial Park by Forest Insect and Disease Survey staff of NoFRC.

Aerial surveys were conducted of all major pest infestations in the region. These included mountain pine beetle, jack pine budworm, spruce budworm, forest tent caterpillar, and mistletoe.

The new forest pathology project concentrated on studies of western gall rust and Armillaria root rot. Excellent cooperation was received from the University of Alberta and resulted in coordinated studies.

Mortality factors affecting young reforested lodgepole pine and jack pine were assessed. Efficacy testing was continued of important herbicides and pheromones. Cone and seed insect studies were expanded.

**Regional Development**

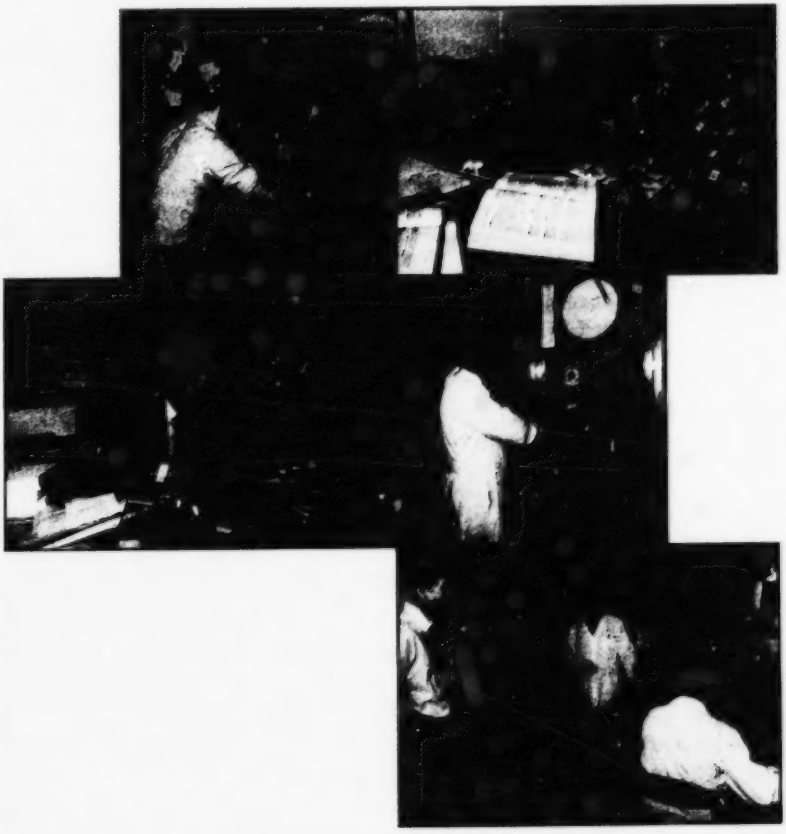
Dr. Mike Heit was appointed Program Manager of the new Regional Development Program in March 1983.

Organizationally, the Regional Development Program was established to facilitate implementation of the CFS mandate vis-a-vis nonindustrial forestry subsidiary agreements. Program staff comprises nine positions allocated to NoFRC during the 1982-83 operating year plus the Economics Unit involving a staff of two forest economists and three research technicians. Two program staff members--a Development Officer and a Clerk-Secretary--were added to our Winnipeg suboffice to provide on-site capability in the development and implementation of federal-provincial agreements. A decision was also made to establish a new suboffice in Prince Albert, Saskatchewan, by early summer of 1983.

Provincial forestry profiles were prepared for Manitoba, Saskatchewan, and Alberta. Discussions were initiated with senior forestry officials in all three prairie provinces to explore needs and opportunities for new federal-provincial forestry development agreements. Negotiations with Manitoba and Saskatchewan resulted in the identification of programs and funding levels to be considered for inclusion in the proposed agreements. A Canada-Alberta Employment Stimulation Agreement was signed in late 1982 and provided a total of 426 person-weeks of employment for workers collecting unemployment insurance benefits.

A.D. Kiil

Regional Director of Forestry



## ENVIRONMENTAL FORESTRY RESEARCH

### PROJECT NOR-7

**Reduction of damage from pollutants in the atmosphere**

**Objectives:** To determine the impact of air pollutants from the extraction and processing of natural resources on forest vegetation and soils; to develop diagnostic techniques to assess the effects of pollutants both singly and in combinations on the forest system; to provide a capability to predict the long-term implications of pollutant deposition on plant and soil systems.

**Achievements:** Air pollutants such as sulfur dioxide, nitrogen dioxide, heavy metals, and elemental sulfur, which are characteristic of natural gas and oil extraction processing, are the primary targets of the research. Base-line descriptive studies on the pattern and impact of pollutant deposition have been completed for the Athabasca oil sands and Rocky Mountain House areas. Laboratory and field studies on soils and both higher and lower plant species have produced biomonitoring techniques, some of which are currently being used in the vicinity of sour gas processing. Numerous other techniques are being further refined. Studies have been initiated on the interaction of environmental and biotic factors that influence pollutant uptake and produce an impact on boreal and mountain plant species. Preliminary results indicate that a substantial amount of work is needed before the capability to predict pollutant impact on selected species can be reached. This is particularly true when air pollution impingement consists of several pollutants or occurs through the soil system. The latter is under investigation in an area of substantial elemental sulfur deposition close to sour gas processing in west-central Alberta.

Impact assessment and preliminary results of both field and laboratory studies have been presented to Canterra Energy Ltd., Gulf Canada, provincial environment departments, and other appropriate agencies. Articles were published on biochemical, physiological, and ecological aspects of air pollution impact on plants.

**1983-84 objectives:** To publish articles on biomonitoring techniques, impact of pollutants on moss communities, and vascular plant and lichen physiology; to continue to measure the rate and effect of pollutant deposition on soil chemistry and subsequent plant response; and to continue studies on the influence of $SO_2$ on jack pine.

**Studies:**

Assessment of air pollution impact on forest systems
Impact of air pollution mixtures on forest vegetation and soils

### PROJECT NOR-13

**Maintenance and improvement of water yield and quality**

**Objectives:** To provide forest managers with practical management prescriptions and guidelines that will stabilize or improve the quantity, quality, and delivery time of water from forested areas.

**Achievements:** Three subbasins (Cabin, Middle, and Twin) of the Marmot Experimental Watershed in the Kananaskis River valley, Alberta, have been calibrated. A commercial harvest of the Cabin subbasin did not increase sediment in the stream, but did increase annual streamflow by about 30 mm. Over 2000 circular openings, one tree-height in diameter, were cleared on the Twin subbasin. These clearings contain about twice as much snow at peak accumulation as the uncleared areas between them. Streamflow from the Twin subbasin is being evaluated against that of the Middle subbasin, which has not been harvested.

Numerous clearings less than 0.4 ha were created in aspen forest on the Streeter Experimental Watershed in the northern Porcupine Hills, Alberta. These were expected to retain snow on the upper slopes and to allow the meltwater to infiltrate the soil and appear as local spring flow. The result was a 48% increase in water yield during the 5 years after treatment. Regrowth of vegetation and its effect on spring flow continue to be monitored.

A US Forest Service procedure for predicting the effects of forest harvesting activities on annual streamflow has been adapted for use in Alberta. The procedure predicts the long-term annual yield of ungauged catchments within 10% of actual.

**1983-84 objectives:** To provide forest managers with practical management prescriptions and guidelines that will stabilize or improve the quantity, quality, and delivery time of water from forested areas; to investigate and evaluate the effects of traditional and nonstandard forest clearing practices on microclimate and soil moisture as they affect regeneration, establishment production, and rotation duration.

**Studies:**

Research coordination in the Alberta watershed research program: Marmot and Streeter experimental basins
Disposition of water in forest soils
Measuring evapotranspiration of forests and clearings
Snow accumulation and ablation in forest openings
Vegetation manipulation--hydrologic modeling

## PROJECT NOR-22

### Remote sensing applications

**Objectives:** To evaluate, develop, and apply new remote sensing and interpretation techniques for forest inventories and environmental management purposes in collaboration with center colleagues, other federal agencies, provincial governments, educational institutions, and industry; to develop improved forest management information systems and apply the data bases in simulation models to test various management strategies; to provide advisory services in survey design, interpretation methods, and analyses.

**Achievements:** A large-scale photo sampling system has been approved by the Ministry of Transport for fixed- and rotary-wing aircraft operations. In-house and Northern Development Program funding has supported the design, specifications, and contract supervision for the assembly and operational development of the large-scale photo acquisition and semi-automated interpretation system. Further

development and operation trials in the Yukon have received encouragement and support.

A computerized Mapping and Analysis of Resources System is operating and has been updated to Version-2 capabilities. Sample forest inventory maps from each of the prairie provinces and the Northwest Territories have been digitized for demonstration purposes. The Version-2 update should significantly improve the map digitizing bottleneck in the system and will make the system compatible with maps digitized elsewhere.

New photo-mensuration programs were developed for the Yukon Forest Service's HP-9826 desk-top computer, and older HP-9825 desk-top computer programs were updated at NoFRC.

A report on annual burned area monitoring with satellite imagery for the Northwest Territories was forwarded to the Forestry Statistics and Systems Branch, Petawawa.

**1983-84 objectives:** To complete development, testing, and demonstration of the computer mapping system; to determine the availability and interfacing requirements for digital map exchanges with other agencies; to publish an evaluation of the development and testing of computer mapping; to complete development, testing, and demonstration of large-scale photo sampling through operational trials in the Yukon; to develop a microcomputer-based photo-mensurational interpretation system for timber volume inventories and fuelwood surveys; to publish a report on the use of large-scale photo sampling for regeneration assessments.

**Studies:**

Remote sensing and technical advisory services
Development and application of large-scale photo and image analysis techniques to forestry

**PROJECT NOR-23**

**Ecological land classification of national parks**

**Objectives:** To provide ecological land classification of national parks in western Canada that include landform, soil, vegetation, and wildlife resource components, with an interpretation of the data collected for land-use planning and management.

**Achievements:** An ecological land classification of Banff and Jasper national parks has been completed. Volumes I, II, and III and a map supplement were published. Fieldwork has been completed in Kootenay National Park, and the final report is in progress. Field sampling will be completed in Mt. Revelstoke and Glacier national parks in 1983, with the final report scheduled for completion in 1984.

Cooperating agencies are the Alberta Institute of Pedology (University of Alberta), Agriculture Canada, Canadian Wildlife Service, and Parks Canada.

**1983-84 objectives:** To complete and terminate ecological land classification of Kootenay and Mt. Revelstoke-Glacier national parks.

**Study:**

Ecological land classification of Kootenay and Mt. Revelstoke-Glacier national parks

**PROJECT NOR-28**

**Environmental impact assessments**

**Objectives:** To assess the impact of proposed industrial developments (such as pipelines, roads, and oil and gas exploration north of $60^{o}$ latitude) and to recommend measures to minimize or mitigate their impact; to investigate the ecology of peatlands by studying their dynamics and development.

**Achievements:** Impact assessments were carried out recently in connection with the Beaufort Sea hydrocarbon development, the Norman Wells pipeline, road construction in Banff National Park, and a number of smaller projects. Future research will depend on short-term notices of requests for environmental impact assessments received from senior management of Environment Canada, the federal Cabinet, and other federal agencies or departments.

Natural resource inventories have been carried out on Bylot Island-Eclipse Sound, Axel Heiberg Island, Banks Island, and at Bathurst Inlet, NWT, in connection with the proposed establishment of national parks.

A research program on the ecology of wetland development was initiated in the boreal zones of Alberta, Saskatchewan, and Manitoba. Each year about 60 different peatlands are investigated, and hundreds of plant and peat samples are collected. Botanical origin of the peat is examined, and the fossil plant association is determined. The calorific value and radiocarbon age of some samples are obtained.

**1983-84 objectives:** Assessment of environmental impacts of proposed industrial development will be continued. Peatland ecology work will be undertaken in Saskatchewan.

**Studies:**

Environmental assessment and impact of developments on the terrestrial environment
Peatland development and ecology

**PROJECT NOR-31**

**Climatic studies**

**Objectives:** To provide information to assess the impact of climate on forest vegetation and soils, including the effect of short-term and long-term climate fluctuations on forest biomass productivity; to represent the CFS and NoFRC on

advisory committees, including those associated with the Canadian Climate Program.

**Achievements:** Two ENFOR contracts (P-149 and P-150) are directly related to this project. Final reports on these two projects are being prepared for publication. Presentations on the two contracts were published in the Proceedings of the 4th Bioenergy R & D Seminar held in Winnipeg, Manitoba, under the titles of "Impact of climatic variation on biomass accumulation in the boreal forest zone: selected references" and "Impact of climatic variation on boreal forest biomass through the use of tree-ring analysis." In association with the tree-ring data, 90 climate stations in the prairie region and adjacent area are being studied for data on annual and seasonal temperature and precipitation trends and variations.

Information on mean monthly minimum and maximum temperatures, growing degree-days, and frost-free period was prepared for 27 short-term (3-6 years) stations in the Hinton, Alberta, area. Additional temperature data were extracted from a pine and spruce seedling growth study carried out on four clear-cut areas near Hinton, and the data were summarized for growing degree-days information.

**1983-84 objectives:** To publish reports on the two ENFOR climate-related studies and a paper on the "History and development of the Canadian Climate Program"; to prepare reports on the growing season climate of four clear-cut areas associated with the seedling growth study; to prepare papers in cooperation with Forintek Canada Corporation on tree-ring analysis.

**Study:**

Impact of climatic variation on boreal forest biomass production

**PROJECT NOR-32**

**Reduction of damage from LRTAP and other atmospheric pollution**

**Objectives:** To determine the origin and extent to which long-range transport of air pollutants (LRTAP) is degrading terrestrial ecosystems, with specific reference to soils and vegetation; to investigate the distribution and impact of radionuclides in vegetation and soils around uranium mining and milling operations.

**Achievements:** The LRTAP portion of this project represents a portion of a federal government program studying the impact of acid rain on the natural environment and is being carried out under the auspices of an interdepartmental committee. The ultimate objective is to establish control guidelines for the provinces, with agreement by the United States.

A network of permanent biomonitoring sites has been established to investigate the short-, medium-, and long-range transport of pollutants from smelters at Flin Flon and Thompson, Manitoba. Publications are being prepared on work carried out in these areas. Studies on the effects of metal particulate deposition on soil processes are being carried out to determine the effect of metal accumulation on nutrient cycling. Investigations are under way into the

distribution of radionuclides in the forest environment surrounding abandoned uranium mining and milling operations.

**1983-84 objectives:** To study the effect of regional and national acid rain levels on the growth and physiology of native forest species and soils; to establish and maintain a benchmark and base-line biomonitoring system around a representative newly started uranium development site.

**Studies:**

Impact of air pollutants from major regional sources on forest vegetation and soils
Transport of airborne radionuclides released during uranium mining and milling operations and their effects on forest vegetation and soils

**PROJECT NOR-33**

**Scientific and technical information**

**Objectives:** To provide relevant and timely information to all user clientele (scientific, technical, and public) at a reasonable cost, using the complete range of available communications techniques and information.

**Achievements:** NoFRC has evolved into the principal regional source of information relating to the management and protection of commercial and recreational forests. Research emphasis currently is being placed on intensive forest management practices (particularly as related to regeneration, tree improvement, insect and disease control in plantations, and stand tending), watershed management, fire management systems, remote sensing, economics, resource data analyses, land classification, toxic substances, and environmental concerns.

In 1982-83, 10 Information Reports, 7 Forest Management Notes, 3 Forestry Reports, and 40 journal articles and miscellaneous publications were published. The three Forestry Reports and an Information Report on regional forestry statistics and an Information Report on silviculture statistics for Canada received national attention. Information Report NOR-X-236, *Effects of spacing 7-year-old lodgepole pine in Alberta*, received an award of excellence from the Society for Technical Communication, Eastern Ontario Chapter.

About 10 000 requests for information are received annually through the mail and by telephone and personal inquiries. Approximately 35 000 copies of Information Reports and other technical publications, 5000 journal article reprints and miscellaneous publications, 30 000 pest leaflets, and 30 000 copies of regional Ecotour booklets are distributed annually on a request basis. Demand for regionally produced publications remains steady. Nearly 1500 organizations and individuals are on our computerized mailing list and either are automatically sent all publications or three times a year are sent a notice of recent publications. Advice and publications were provided to NoFRC staff involved in preparation and tending of displays. A staff newsletter was produced monthly.

**1983-84 objectives:** To assist the research staff in the preparation, publication, and distribution of scientific, technical, and public information.

**Study:**

Scientific and technical information

**PROJECT NOR-34**

**Forest biomass as an energy source (ENFOR)**

**Objectives:** To develop methodology to quantify the amount of forest biomass available for energy conversion in the region; to assess its cost in use; to determine the physical and socioeconomic impact of its availability and use.

**Achievements:** ENFOR is the acronym for the ENergy from the FORest program funded by the federal Department of Energy, Mines, and Resources and administered by the Canadian Forestry Service. Since the program began in 1978, contracts have been awarded to private organizations for studies on biomass availability, biomass harvesting, environmental impacts of production and harvesting, and intensive silviculture for increasing biomass production. The following contracts continued in NoFRC's region in 1982-83 (they are also listed in Appendix E, which shows contractor, complete project title, expenditures, and scientific authority): 1. Determination of biomass and nutrient content in trees, ground vegetation, and soils of aspen stands in Alberta (P-205), and 2. Development of an integrated harvesting and processing system for aspen wood products and energy production (P-207). Two final reports were published, and others are being prepared for previously completed contracts.

In addition, two service contracts were completed: one to analyze the tree-ring samples from a young (90-100 years old) white spruce site in Alberta and another to review the literature regarding the heat of combustion values for the major tree species of the prairie provinces.

Reports were published on *Upper limits of standing crop density for woody species in the prairie provinces*, *Biomass equations for ten major tree species of the prairie provinces*, and *Weight tables for important tree species in the prairie provinces*. Presentations on four of the ENFOR contracts (P-149, 150, 169, and 205) were published in the Proceedings of the 4th Bioenergy R & D Seminar, and a paper on another contract (P-148) was published in the Proceedings of the Canadian Institute of Surveying Centennial Convention. In addition, aspects of two studies were highlighted in issues of the ENFOR Newsletter.

**1983-84 objectives:** To complete project P-205; to start four new studies, two in conjunction with the Forestry Statistics and Systems Branch, Petawawa National Forestry Institute, as listed below:

1. Integrated utilization for wood products and energy in Manitoba (P-254),

2. Green-volume specific gravity of tree species in the prairie provinces (P-255),

3. Biomass equation approach for tree species in Manitoba (P-270), and

4. Nondestructive sampling of noninventoried areas and nonsampled cover types in the prairie provinces and Northwest Territories (P-273).

**Studies:**

An assessment of the energy potential of forest biomass in the prairie provinces and Northwest Territories

Development of integrated biomass prediction equations for the Western and Northern Region

**PROJECT NOR-52**

**Analytical services**

**Objectives:** To provide analytical services to individual scientists at NoFRC and cooperators for the elemental and related analyses of soil, vegetation, and associated materials.

**Achievements:** Many of the research activities at NoFRC require analytical expertise that is not available with the individual projects. The analysis of soils, waters, and plant materials has been provided on an ongoing basis through the Analytical Laboratory facilities.

**1983-84 objectives:** To maintain an adequate Analytical Services Laboratory to provide elemental and other related analyses of soils, vegetation, and water.

**Study:**

Analytical services laboratory

## FOREST RESOURCES RESEARCH

### PROJECT NOR-4

**Yields of managed stands**

**Objectives:** To develop and assess silvicultural options and treatments for increasing yields of managed stands; to provide forest management agencies with improved techniques and models for growth and yield prediction for the commercially important cover types and management options in the prairie provinces and NWT.

**Achievements:** Numerous long-term studies that have been initiated in the past to provide prescriptions for spacing, thinning, and fertilization of lodgepole pine, jack pine, white spruce, and trembling aspen in the region are being monitored; the results are being published as they become available.

During 1982-83 a journal article was published on the effect of strip thinning on the growth of lodgepole pine in Alberta 15 years after treatment. A Forest Management Note described the response of a mature lodgepole pine stand to heavy commercial thinning. An intensive, short-term study to determine the effect of line clearing (seismic, pipe, etc.) on tree and stand growth and yield in the commercial forest zones of western Alberta was completed, and a final report has been submitted to the Alberta Forest Service. A paper on regeneration stocking-density relationships was presented at a symposium on Forest Regeneration in Northern Latitudes, held in Hinton, Alberta, in August 1982.

A demonstration of STEMS (Stand and Tree Evaluation and Modeling System) was presented for trembling aspen and jack pine tree and stand growth at the annual meeting of the Canadian Institute of Forestry, Rocky Mountain Section. A simplified version of the model has been tested on NoFRC's PDP-11/60 computer.

Analysis of the growth response of 70-year-old lodgepole pine to N, P, and S fertilization has been completed; preliminary results were presented at the Forest Regeneration in Northern Latitudes symposium. An Information Report detailing the effects of fertilization on mature pine stands is in preparation. Remeasurement to assess 10-year growth response of 30-year-old lodgepole pine to fertilization was completed, and analysis of data is in progress. A journal article that assessed the usefulness of the response surface analysis technique for predicting seedling growth response to fertilization treatments was accepted for publication.

**1983-84 objectives:** To develop spacing guidelines for lodgepole pine that consider early mortality; to initiate a study to determine the cause and duration of exceptionally rapid juvenile growth of lodgepole pine following logging and scarification in the Edson Forest; to complete the calibration of STEMS for lodgepole pine and white spruce and to organize a workshop on its use for outside agencies; to publish reports on the effect of fertilizing 30- and 70-year-old lodgepole pine stands and on the relation between soil, foliar data, and tree growth; to initiate a study on the effect of thinning and fertilization of semimature lodgepole pine.

**Studies:**

Growth and yield of five commercially important native species in Alberta, Saskatchewan, and Manitoba

Stand modeling of the growth and development of important forest types in the prairie provinces
Transformation and movement of applied fertilizer elements (N, P, S) in selected lodgepole pine stands
Fertilization of established lodgepole pine stands
Fertilization and thinning of semimature lodgepole pine stands.

## PROJECT NOR-5

### Fire management systems and guidelines

**Objectives:** To provide standards, operational guidelines, and decision aids to land managers that will reduce, at an acceptable cost, damage and loss from forest fires while considering the related economic, ecological, and social factors.

**Achievements:** The performance and effectiveness of air tankers and retardants were evaluated on six fires. Technical assistance was provided to industries engaged in the development of a prototype vinyl heli-bucket. A new 1000-container drop grid system was constructed. A national fire behavior data base by fuel type (determined from experimental fires and selected wildfires from Canada and the U.S.) was assembled during two working meetings of the danger rating group. Interim danger index classes for the proposed Fast Drying Spread Index (FDSI) and a fire danger climatology for the new Sun-exposed Fine Fuel Moisture Code (SFFMC) were provided to all user agencies in the Western and Northern Region. A 10-day experimental burning project was conducted in the black spruce-lichen woodland fuel complex at Porter Lake, NWT, by fire research staff from NoFRC, the Pacific Forest Research Centre, Great Lakes Forest Research Centre, and Petawawa National Forestry Institute. Ten experimental burns (seven line and three point-source ignitions) and one wildfire were documented under low to extreme fire danger conditions. Five lightning fires were documented in Saskatchewan to gather data in support of a lightning fire prediction model.

The NoFRC-developed scan extender is now Ministry of Transport approved. Using a Navaho aircraft flying at different speeds and elevations, several Thermovision lenses were tested for sensitivity and coverage. Six firefinders were constructed at NoFRC for the Saskatchewan Department of Tourism and Renewable Resources. Fieldwork necessary for the construction of seen area maps was completed for 11 towers in Riding Mountain National Park. Elk Island National Park personnel were assisted in a prescribed burn in the spring of 1982. Two Forest Management Notes were published on *Calculating spring Drought Code starting values in the prairie provinces and Northwest Territories* and *Diurnal adjustment table for the Fine Fuel Moisture Code*. An article on "Fire behavior in aspen slash fuels as related to the Canadian Fire Weather Index" was published in the Canadian Journal of Forest Research, and an article entitled "An initial attack planning model" was published in the Proceedings of the Intermountain Fire Council. Progress was made on several reports to be published in the coming year. Fire research staff participated extensively in technological transfer activities, training sessions, committees, workshops, manuscript reviews, and guest lectures at universities and with forestry agencies.

**1983-84 objectives:** To continue fieldwork to document the on-site effectiveness of retardants and air tankers; to collect additional data on lightning fires immediately following ignition; to initiate a fuel description study in Jasper

National Park and to continue experimental burning in Elk Island National Park; to direct a major effort this year toward writing and publishing research results.

**Studies:**

Fire retardant and air tanker evaluations and applications
Fire behavior in boreal forest fuels
Evaluation and planning of fire detection, surveillance, and communications systems and methods
Evaluation of the role of fire in forest and intermingled vegetation in the prairie provinces, Rocky Mountains, and far North
Decision-aid models for use in fire management
Fire danger and behavior rating in forest and rangeland environments

**PROJECT NOR-10**

**Silvicultural investigations**

**Objectives:** To formulate planning tools and guidelines for promoting an effective federal role in improving standards of management of regional forest resources, particularly in the areas of prompt regeneration, seedling production, storage and field performance, site productivity, tree physiology, and data bank and model development.

**Achievements:** Between 1958 and 1979 this project concentrated on assessing and developing site preparation techniques (including scarification and prescribed burning), developing and assessing container planting systems (including work on container type and size), and developing guidelines for rearing containerized seedlings, covering a range of production criteria from seed through to nutrition and hardening-off of stock. Work has continued to the present to ascertain preplanting conditioning and overwintering techniques to reduce losses and improve field performance of stock being produced in the region. Reporting is now under way on the effects of frost and other agents on the establishment of spruce and pine container stock and on field structures to minimize field storage damage.

Performance of both bare-root and container stock planted under a range of field conditions continues through assessment of past CFS research plots and through a contract with the Alberta Forest Service. A silviculture data bank is being developed to provide background data in support of silvicultural prescriptions and decision aids. The bank will have a national component using data being collected and reported by NoFRC as part of the Canadian Forest Resource Data Program.

Since 1980 significant amounts of planting stock have been heavily browsed by snowshoe hares, and an overview of hare damage across the region is being prepared. More action on this problem is urgently required if planting performance is to be successful.

There has been a continuing and effective liaison service in nursery management, cultural operations, and disease control. The liaison function has been especially significant since 1976 with the rapid increase in high-technology greenhouse production of containerized seedlings at both government and industrial nurseries throughout the region. At the same time, bare-root

production has expanded, requiring additional work on nursery soil management, nutrition, and insect and disease control. Demand continues to be strong for Information Report NOR-X-214, *Guidelines for rearing containerized conifer seedlings in the prairie provinces*, revised in 1983.

Recently, studies have been initiated in tree seed and seedling physiology, especially the latter as it relates to cold hardening and dormancy processes. In conjunction with the Alberta government and provincial industries, forest ecology and site productivity research is also under way, with emphasis on synthesizing forest association, vegetation, and environmental descriptions within a biogeoclimatic framework and developing a forest management field guide based on forest associations.

During 1982 a mechanization of silviculture component was added to the project as part of a National Mechanization of Silviculture Program. Initial emphasis will be on a regional equipment inventory, and there are plans to undertake equipment evaluations.

**1983-84 objectives:** To continue to develop working relationships with national programs such as FORSTATS (Forestry Statistics) and NACMEC (NAtional Committee for the MEChanization of Silviculture); to hire a nursery operations officer to work in both nursery liaison and research; to add new emphasis to silviculture research and technology transfer in Manitoba and Saskatchewan through the regional office in Winnipeg; to continue work in plant physiology and pla ecology; to promote a new integrated study on boreal white spruce reforestation; to further develop NoFRC's research coordinating role through the Regional Reforestation Technical Committee.

**Studies:**

Nursery operations
Nursery soil fertility and seedling growth
Conditioning, winter storage, and initial field performance of containerized conifer seedlings
Development of silviculture data base and management tools for forest resource planners
Field performance of planted stock
Forest tree seed and seedling physiology
Forest ecology and site productivity
Silvicultural research and technology transfer, Manitoba and Saskatchewan

## PROJECT NOR-12

**Tree improvement**

**Objectives:** To improve the quality of reforestation stock for use by forest land managers by breeding or identifying and introducing genetically superior populations of commercial forest species; to produce genetically improved grafts, seedlings, or rooted cuttings of seedlings of jack pine in sufficient quantity for establishment by cooperators of plantations for mass production of genetically improved planting stock.

**Achievements:** Measurements from jack pine family test plantations in eastern Manitoba at 10 years from planting were analyzed, and the results were used to

select the best 40 families of 209 planted. Progeny mean volume for the selected families was 26% greater than the mean volume for all families. In cooperation with the Manitoba Forestry Branch, about 900 scions from clone bank grafts of the selected families were grafted to produce stock for an eastern Manitoba seed orchard. Grafting of seed orchard stock was also done for western Manitoba and for Saskatchewan (in cooperation with the Saskatchewan Forestry Division) using families selected for superior progeny mean height at 5 years from planting. A Forest Management Note and an Information Report on the jack pine breeding program were published.

The number of planted grafts in good condition in the clone bank increased from 2016 to 2130 in 1982. Grafting for the clone bank in 1982 reduced the number of additional grafts required from 508 to 104, and all but a few of those 104 were done in April 1983. Most of the clone bank grafts on hand that were not planted in the clone bank were planted in a holding area at NoFRC.

A plan for a cooperative seed orchard development program for Manitoba was favorably received and has been included as part of a proposed federal-provincial forestry development agreement.

**1983-84 objectives:** To publish results of the 10-year measurement in eastern Manitoba in a Forest Management Note; to measure family test plantations in western Saskatchewan at 10 years from planting and to analyze the data.

**Studies:**

Provenance tests for coniferous species
Breeding jack pine for the northern region. I. First selection cycle

**PROJECT NOR-29**

**Forest resource data**

**Objectives:** To collect and interpret forestry statistics at the regional and national levels in order to provide advice and guidelines to resource managers and researchers in support of forest policy decision making.

**Achievements:** This is a regional project that forms part of the Canadian Forest Resource Data Program, which is being coordinated across the country by the Forestry Statistics and Systems Branch located at the Petawawa National Forestry Institute. Regional statistics have been collected for inclusion in national reports on forest inventories, seed collection, and nursery facilities. Other subjects of interest to policy and decision makers, including inventory depletions resulting from harvesting, fire, insects, and diseases, will be addressed in the future. Silviculture statistics for Canada were collected and analyzed at NoFRC for the 5-year period 1975-80, and a report summarizing the data has been published. In addition to maintenance of a computerized system for the compilation and analysis of regional forestry statistics, periodic reports will be prepared and distributed. Regional simulation models will be developed and tested to provide statistical forecast trends.

**1983-84 objectives:** To collect, analyze, and publish national silviculture statistics for 1980-81 and 1981-82.

**Study:**

Forest resource and operations statistics in the prairie provinces and Northwest Territories

**PROJECT NOR-53**

**Computing and data processing**

**Objectives:** To provide problem-solving and other consulting services regarding various types of analyses using the PDP 11/60, HP 1000, TEKTRONIX 4051 graphics terminal, and HP 9825 in-house computers; to provide programming, data entry, and keypunching courses in FORTRAN, computer fundamentals and utilities, and computer-related consulting; to advise on statistical procedures and system analysis and design where possible; to provide any other computer-related service and advice that may be required by staff at NoFRC as well as other agencies and outside users.

**Achievements:** Four test inventory maps, one each from Alberta, Saskatchewan, Manitoba, and the NWT, have been digitized for use with regression coefficients to predict biomass. A new version of the operating system for the PDP was installed and is now running, as are the new FORTRAN 77 compiler and the latest release of MINITAB. More work was done with the biomass equations, and the TEKTRONIX plotting routines were improved and expanded to provide graphical output. Programs were written to help analyze growth performance, compile bark beetle cruise data, summarize temperature data, compare specific gravity from different elements, establish regression equations for NWT biomass predictions, classify temperatures and give percentages per class, ascertain if fertilizer data were significant, and manipulate Forest Insect and Disease Survey data. Two APPLE II programs were prepared for a multistrike initial-attack planning model for the Alberta Forest Service utilizing Albini's spotting distance prediction model. Other programs were improved or written for sorting address labels, regression line plotting with confidence bands, genetics, and PARKS. University of Alberta (U of A) textform commands were used on the PDP 11/60 to create a file that could be used at the university.

The in-house and U of A computing systems involve more than 35 people and another 10 or more students using a variety of interactive terminals and batch processing. An estimated workload of over 10 000 tasks per month is being handled by the systems and is expected to increase over the next year.

**1983-84 objectives:** To continue to supply and expand services rendered and to receive, test, and install new programs, updates, and versions on all systems; to supply any needed programming for the ENFOR project to determine biomass or other needs; to prepare a RAMS mapping demonstration for the provinces and NWT.

**Study:**

Computing and data processing services

## FOREST PROTECTION

### PROJECT NOR-1

**Detection and appraisal of tree pests and vegetative disturbances**

**Objectives:** To gain an improved knowledge of major forest insects and diseases for the purpose of understanding and minimizing damage attributable to these organisms; to contribute to a national overview of important pests and their implications.

**Achievements:** Annual surveys of important pests and conspicuous forest damage have been conducted since 1941. Infestations of major insect and disease outbreaks have been monitored, and their impact on the forest resource has been assessed. Major insect problems monitored in 1982-83 include the mountain pine beetle, spruce budworm, jack pine budworm, and forest tent caterpillar. Scleroderris cankers in plantations, pine stem rusts in tree nurseries, and Dutch elm disease in urban settings are the principal diseases undergoing investigation. Appraisal of damage by major forest pests to obtain depletion figures continued. Intensive surveys of dwarf mistletoe infected forests were initiated. NoFRC was represented on a combined United States-Canada committee to review the mountain pine beetle problem. Trials on the applicability of Landsat data for aerial assessment of aspen defoliation were supported.

A pest extension service for a wide variety of clientele and training sessions on major pests in this region for forestry personnel have continued. More than 1500 inquiries were processed in 1982. The insect reference collection, the disease reference collection, and the fungus culture collection have been maintained and upgraded. Taxonomical and biological studies of sawflies are continuing. Field experiments were conducted to test spruce budworm pheromones and mountain pine beetle attractants for use in monitoring or controlling insect populations.

An annual report was prepared on forest insect and disease conditions in the region.

**1983-84 objectives:** To survey, map, and report on major forest pest infestations such as the mountain pine beetle, forest tent caterpillar, spruce budworm, and jack pine budworm; to monitor other noteworthy forest insects and diseases; to provide diagnostic and advisory services; to produce a draft of a standard survey methodology manual for the region; to assess operational use of satellite imagery.

**Studies:**

Forest insect and disease survey
Sawfly systematics
Control and damage impact of insects injurious to trees and shrubs
Forest insects: diagnostic and taxonomic services
Damage appraisal of major forest pests

### PROJECT NOR-9

**Forest insect and vegetation systems**

**Objectives:** To evaluate the use of herbicides, pesticides, and pheromones as tools in forest management; to evaluate the relative importance of various

environmental factors in early mortality of reforested pine stands; to assess the impact of white spruce seed and cone insects and to develop methods for controlling them.

**Achievements:** Survival in established herbicide plots was monitored, and expanded field testing of Velpar in granular and liquid form as well as trials involving an unnamed pre-emergent herbicide were conducted. Conifer release on heavy clay soils was poor, but good control of competing vegetation was achieved on light sandy soils.

Extensive field testing of synthetic pheromones for *Proteoteras* (boxelder twig borers) and *Petrova* (pitch nodule makers) was conducted, and the formulations were refined. Large numbers of insects in both genera were caught in the traps, but the baits were not specific: three *Proteoteras* species and two *Petrova* species were caught.

An additional 200 small plots were established in young lodgepole pine stands in the Hinton area of Alberta, while nearly 400 similar plots were established in jack pine plantations in the Sandilands Forest Reserve in Manitoba. Mortality during 1981-82 was monitored for all lodgepole pine plots established in 1981. Preliminary results indicate that mortality rates increase as the age of young stands increases. If present trends continue, approximately half of the original trees will have died after 30 years from stand establishment, 7 years after cutting.

Injections of Bidrin and Metasystox R into white spruce trees by Mauget pressurized capsules gave good control of seed and cone insects. Soil-drench treatments involving Temik 10 G, Temik 15 G, and Furadan were ineffective, probably due to drought conditions.

**1983-84 objectives:** To continue evaluation of liquid and granular formulations of Velpar and the unnamed herbicide for conifer release and to conduct further assessments of the synthetic pheromones; to monitor the survival of lodgepole pine in 60 study areas near Hinton, Alberta, and to intensify efforts to obtain color photographs and information for an illustrated handbook on forest and shade tree insects of the region; to continue the assessment of systemic insecticides for controlling infestations of white spruce seed and cone insects.

**Studies:**

Chemical controls of pests and vegetation in managed forests
Evaluation of mortality in stands of young trees in plantations and scarified areas
Insects and diseases affecting seed production in the prairie region

**PROJECT NOR-17**

**Forestry services**

**Objectives:** To provide advisory services to forest resource managers in silviculture, forest management practices, and forest insect problems.

**Achievements:** The solutions to many forest management problems do not require long-term research. Often the answer lies in the application of existing knowledge. By working closely with provincial and industrial forest management

personnel in defining a problem and selecting and testing promising forest management techniques, it is possible to upgrade forestry practices in the region. During the past year the following services were initiated or successfully completed:

1. Effective communications were maintained in Manitoba through the Winnipeg suboffice. Technology transfer and liaison services were supplied to provincial government agencies and the forest industry.

2. A draft of a report reviewing jack pine research and operational information related to reforestation in the Sandilands Forest Reserve, Manitoba, was completed.

3. NoFRC researchers were assisted in the measurement of studies in Manitoba.

**1983-84 objectives:** Project was terminated. Uncompleted goals were transferred to Project NOR-10.

**Study:**

Liaison and technical advisory services--Winnipeg suboffice.

**PROJECT NOR-35**

**Tree disease research**

**Objectives:** To gain improved knowledge of the biology, pathology, and epidemiology of selected tree diseases, especially forest tree rusts and other diseases of intensively managed young conifer forests; to determine the effects of ice nucleating agents on cold tolerance of seedlings and to develop effective overwintering guidelines to enhance field performance; to maintain and upgrade the mycological herbarium and a fungal culture collection; to conduct short-term taxonomic investigations of selected forest fungi.

**Achievements:** Principal areas of research under investigation in the past year were western gall rust of lodgepole pine and jack pine, Armillaria root rot of young conifer forests, effects of ice nucleating agents on cold tolerance of conifer seedlings, and blue stain fungi and other microorganisms associated with mountain pine beetles. A study of bioactive metabolites of forest disease pathogens is in progress in cooperation with chemists at the University of Alberta (U of A). A contract report on aspen and balsam poplar decay was prepared for the Alberta Poplar Research Committee. Cooperative arrangements with the U of A Forest Science and Plant Sciences departments and the Alberta Forest Service have been established to conduct joint research and to supervise thesis research of two graduate students.

This project is supported partly by a grant from the Alberta Forest Research Trust Fund (Armillaria root rot investigation), a contract with the Alberta Forest Service (western gall rust investigation in relation to the lodgepole pine improvement program), and a strategic grant from NSERC (investigation of blue stain fungi associated with mountain pine beetles).

**1983–84 objectives:** To continue investigation of western gall rusts, Armillaria root rot, effects of ice nucleating agents on cold tolerance of conifer seedlings, and microorganisms associated with blue stain fungi; to prepare and publish several journal papers and Information Reports.

**Studies:**

Forest tree rusts of western North America
Forest diseases: research and technical transfer services
Canker, dieback, and mortality of juvenile forest trees and amenity species

## REGIONAL DEVELOPMENT

### PROJECT NOR-3

**Resource opportunities and policy guidelines**

**Objectives:** To provide socioeconomic information to regional forestry clientele to facilitate policy formulation; to identify opportunities for industrial development; to estimate the major economic benefits and impacts from the forest industry for regulation of trade and commerce, enhancement of employment opportunities, and monitoring of industrial efficiency.

**Achievements:** The primary focus of this project has been an assessment of the forest-based economy of the prairie provinces. Following detailed surveys of the forest industries in the prairies and NWT between 1979 and 1981, the last of a series of reports are being prepared for final publication. Accomplishments for 1982-83 include final review and publication of a comprehensive information report on the forest industry in Alberta, preparation of first drafts of similar reports for Saskatchewan, Manitoba, and the NWT, preparation and publication of information pamphlets on the forest industries in Alberta, Saskatchewan, and Manitoba, and the preparation of a management information system that includes relevant forest economic data in the region.

Additional achievements during this fiscal year included providing support to CFS management in the preparation of documents initiating establishment of the forestry subagreements in the prairie provinces.

**1983-84 objectives:** To continue to provide socioeconomic data for regional and national forest statistics programs and to other users; to continue to provide economic expertise to ensure effective implementation of forestry development agreements in the prairie provinces; to continue to identify areas for economic analysis in intensive forest management.

**Study:**

An assessment of the forest-based economy of the prairie provinces and NWT

### PROJECT NOR-36

**Forest resource development agreements with the prairie provinces and NWT**

**Objectives:** To initiate, discuss, negotiate, implement, and administer the joint federal-provincial forestry development agreements in Alberta, Saskatchewan, and Manitoba; to prepare the necessary documentation in support of the agreements; to provide technical support for program design for forestry agreements in the prairies and the forestry-related component of the renewable resources subagreement in the Northwest Territories.

**Achievements:** In order to provide the required program delivery capability, nine additional positions were allocated to NoFRC. Staffing action was initiated, and to date four of these positions have been filled.

The documentation process for the agreements was initiated with the preparation of provincial forestry profiles and the more-strategic provincial

concept papers for each of the prairie provinces. A considerable amount of time was devoted to preliminary negotiations to establish administrative and management procedures and contacts to facilitate program delivery. Discussions were initiated with senior forestry officials in the provincial governments and with Federal Economic Development Coordinators in Edmonton, Regina, and Winnipeg. More-detailed discussions were carried out with the provinces of Manitoba and Saskatchewan, and potential program areas for inclusion in the development agreements were identified.

**1983-84 objectives:** To negotiate, sign, and implement a Canada-Manitoba Forestry Development Agreement and a Canada-Saskatchewan Forestry Development Agreement; to initiate negotiations for a Canada-Alberta Forestry Development Agreement; to assist in the implementation of the NWT Natural Resources Subagreement; to continue negotiations and implementation of the Forest Employment Stimulation Program in the prairie provinces and NWT in support of regional development.

**Studies:**

Manitoba Forestry Development Agreement
Saskatchewan Forestry Development Agreement
NWT Renewable Resources Subagreement

**PROJECT NOR-54**

**Support services (regional development)**

**Objectives:** To plan and implement a work program to meet the objectives of the Regional Development Program; to manage the person-year and financial resources allocated to the program.

**Achievements:** In late 1982, the CFS received a mandate for the development and implementation of federal-provincial forestry development agreements. NoFRC was allocated nine person-years and operating funds to implement the new Regional Development Program in the prairie provinces and NWT. As part of this, suboffices have been established in Winnipeg and Prince Albert. The Canada-Alberta Job Creation Agreement was negotiated and implemented, and the organizational structure has been established to implement the Regional Development Program in Alberta, Saskatchewan, and Manitoba. Discussions have been initiated with senior officials in the prairie provinces to explore needs and opportunities for the federal-provincial development agreements.

**1983-84 objectives:** To establish and maintain contacts and working relationships with provincial and federal agencies, the forest industry, universities, and related groups; to continue program planning for forestry agreements and employment stimulation; to continue discussions and negotiations on and to implement forestry development agreements in Saskatchewan, Manitoba, and Alberta; to provide administrative and financial support services.

**Study:**

Management and common support services: regional development program

## ADMINISTRATION

### PROJECT NOR-51

**Financial, administrative, and support services**

**Objectives:** To provide a system of financial control and accountability in accordance with statutory and regulatory requirements; to provide general administrative support services, including materiel management, records management, engineering, building maintenance, secretarial and office services, and vehicle fleet management.

**Achievements:** Financial management and accounting were maintained in keeping with the pertinent regulations. Statements were prepared, expenditures were reviewed, and person-years were controlled. Physical facilities were operated satisfactorily, and a preventive maintenance schedule was followed. No major construction or overhauling was undertaken during 1982-83. Materiel management processed approximately 2330 purchases, operated a fleet of 56 vehicles and 26 trailers, and carried out inventory checks at selected field stations. General secretarial, typing, receptionist, and central registry services were satisfactorily maintained. Photographic, library, and electronic technical sections provided a full range of services in support of the research program.

## PUBLIC INFORMATION

**Objectives:** To provide the center with a public information service; to act as the channel through which contact is maintained with the general public and national, regional, and local news media; to produce booklets, news releases, exhibits, and audiovisuals; to handle telephone and written inquiries from the general public.

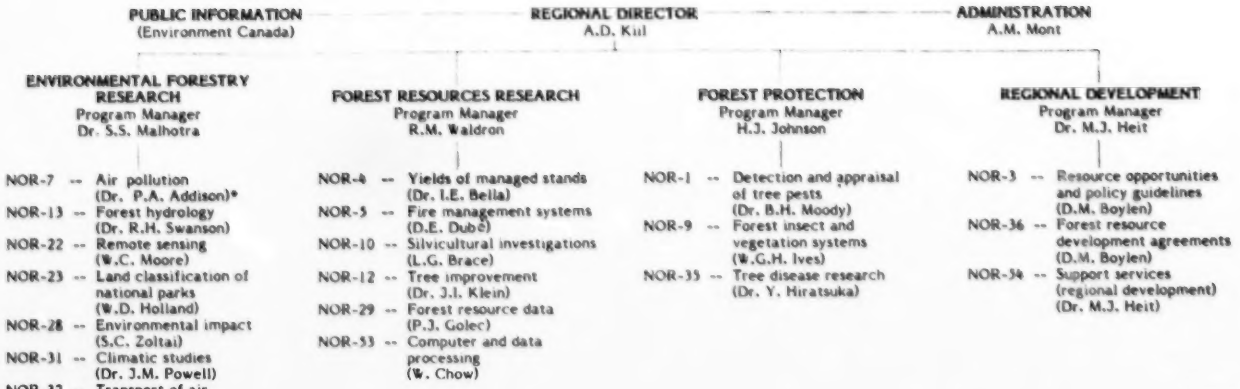
**Achievements:** The Public Affairs Office, Western and Northern Region, Environment Canada, is responsible for the NoFRC public information program.

The NoFRC display was part of a National Forestry Week exhibit at Northwood Mall in Edmonton. NoFRC staff tended the display, conducting a pest clinic and distributing Colorado blue spruce seedlings. News releases and public service announcements were arranged in conjunction with the event. The NoFRC display was also part of a Canadian Environment Week exhibit at Southgate Mall in Edmonton. A National CFS display on Canadian Forestry in Crisis was set up at the University of Calgary in early July and later that month in Regina for Buffalo Days. NoFRC staff tended the display and in Regina distributed seedlings.

Articles on NoFRC activities were prepared for various Environment Canada internal and external publications. Arrangements were made for development of the second part of NoFRC's display. Subjects covered were ecological land classification, forest hydrology, tree genetics, scientific and technical information, and insect, disease, and vegetation management.

## APPENDIX A

## NORTHERN FOREST RESEARCH CENTRE
## ORGANIZATION CHART
(as of March 31, 1983)


PUBLIC INFORMATION
(Environment Canada)
REGIONAL DIRECTOR
A.D. Kiil
ADMINISTRATION
A.M. Mont
ENVIRONMENTAL FORESTRY RESEARCH
Program Manager
Dr. S.S. Malhotra
NOR-7 -- Air pollution (Dr. P.A. Addison)*
NOR-13 -- Forest hydrology (Dr. R.H. Swanson)
NOR-22 -- Remote sensing (W.C. Moore)
NOR-23 -- Land classification of national parks (W.D. Holland)
NOR-28 -- Environmental impact (S.C. Zoltai)
NOR-31 -- Climatic studies (Dr. J.M. Powell)
NOR-32 -- Transport of air pollutants (LRTAP) (Dr. G.D. Hogan)
NOR-33 -- Scientific and technical information (J.K. Samoil)
NOR-34 -- Forest biomass (ENFOR) (Dr. J.M. Powell)
NOR-52 -- Analytical services (Dr. G.D. Hogan)
FOREST RESOURCES RESEARCH
Program Manager
R.M. Waldron
NOR-4 -- Yields of managed stands (Dr. I.E. Bella)
NOR-5 -- Fire management systems (D.E. Dubé)
NOR-10 -- Silvicultural investigations (L.G. Brace)
NOR-12 -- Tree improvement (Dr. J.I. Klein)
NOR-29 -- Forest resource data (P.J. Golec)
NOR-53 -- Computer and data processing (W. Chow)
FOREST PROTECTION
Program Manager
H.J. Johnson
NOR-1 -- Detection and appraisal of tree pests (Dr. B.H. Moody)
NOR-9 -- Forest insect and vegetation systems (W.G.H. Ives)
NOR-35 -- Tree disease research (Dr. Y. Hiratsuka)
REGIONAL DEVELOPMENT
Program Manager
Dr. M.J. Heit
NOR-3 -- Resource opportunities and policy guidelines (D.M. Boylen)
NOR-36 -- Forest resource development agreements (D.M. Boylen)
NOR-54 -- Support services (regional development) (Dr. M.J. Heit)

* Project leader in parentheses

| Staffing | Person-years |
|---|---|
| Management | 4.5 |
| Scientific & professional | 48.9 |
| Technical | 39.0 |
| Administrative & foreign service | 7.5 |
| Administrative support | 15.0 |
| Operational | 10.0 |
| CEIC students | 12.3 |
| Total | 137.2 |

## APPENDIX B

## NORTHERN FOREST RESEARCH CENTRE
## STAFF LISTING
(as of March 31, 1983)

| | |
|---|---|
| Regional Director of Forestry: | A.D. Kiil<br>Secretary - K.W. Conaty |
| Program Managers<br>Environmental Forestry Research: | Dr. S.S. Malhotra<br>Secretary - R.B. Bown |
| Forest Resources Research: | R.M. Waldron<br>Secretary - R.B. Bown |
| Forest Protection: | H.J. Johnson<br>Secretary - K.W. Conaty |
| Regional Development: | Dr. M.J. Heit<br>Secretary - R.B. Bown |
| Regional Chief of Finance and Administration: | A.M. Mont |
| Public Information: | Public Affairs Office,<br>Western and Northern Region,<br>Environment Canada |

### ENVIRONMENTAL FORESTRY RESEARCH
(Dr. S.S. MALHOTRA)

| Project | Title | Professional Staff | Technical Staff |
|---|---|---|---|
| NOR-7 | Reduction of damage from pollutants in the atmosphere | Dr. P.A. Addison (Project leader)<br>Dr. D.G. Maynard | R.G. Radford<br>J.I. Ridgway |
| NOR-13 | Maintenance and improvement of water yield and quality | Dr. R.H. Swanson (Project leader)<br>Dr. P.Y. Bernier<br>Dr. G.R. Hillman | Z. Fisera<br>P.A. Hurdle<br>E.B. Robson |
| NOR-22 | Remote sensing application | W.C. Moore (Project leader)<br>R.J. Hall | T.J. Walsh |
| NOR-23 | Ecological land classification of national parks | W.D. Holland (Project leader)<br>H. A. Dudynsky | D.T. Allan<br>M.D. Fairbarns |

| Project | Title | Professional Staff | Technical Staff |
|---|---|---|---|
| NOR-28 | Environmental impact assessments | S.C. Zoltai (Project leader)<br>J.D. Johnson | M.W. Ali |
| NOR-31 | Climatic studies | Dr. J.M. Powell (Project leader) | N.B. Schultz |
| NOR-32 | Long-range transport of air pollutants (LRTAP) | Dr. G.D. Hogan (Project leader)<br>Dr. M.J. Apps<br>Dr. D.G. Maynard | O.K. Fenn<br>R.G. Radford |
| NOR-33 | Scientific and technical information | J.K. Samoil (Project leader)<br>G.B. Turtle | Word processor operator (vacant) |
| NOR-34 | Forest biomass as an energy source (ENFOR) | Dr. J.M. Powell (Project leader)<br>Dr. T. Singh | |
| NOR-52 | Analytical services | Dr. G.D. Hogan (Project leader)<br>Y.P. Kalra | J. Shuya |

**FOREST RESOURCES RESEARCH**
(R.M. WALDRON)

| | | | |
|---|---|---|---|
| NOR-4 | Yields of managed stands | Dr. I.E. Bella (Project leader)<br>Dr. J. Baker<br>H.S. Grewal<br>Dr. R.C. Yang | V.S. Kolabinski<br>S.J. Lux |
| NOR-5 | Fire management systems and guidelines | D.E. Dubé (Project leader)<br>M.E. Alexander<br>Z. Chrosciewicz<br>G.P. Delisle<br>R.G. Newstead<br>Fire operations (vacant) | M.E. Maffey<br>C.J. Ogilvie<br>R.M. Smith |
| NOR-10 | Silvicultural investigations | L.G. Brace (Project leader)<br>W.J. Ball*<br>Dr. I.G.W. Corns<br>Dr. I.J. Dymock<br>Dr. I.K. Edwards<br>H. Zalasky<br>Nursery liaison specialist (vacant) | F.M. Dendwick<br>J.R. Dyck*<br>J.R. Gorman<br>J.J. van Dyk<br>N.R. Walker |

*Transferred to Winnipeg suboffice on April 1, 1983.

| Project | Title | Professional Staff | Technical Staff |
|---|---|---|---|
| NOR-10 | (continued) | Silviculture forester (vacant) | |
| NOR-12 | Tree improvement | Dr. J.I. Klein (Project leader) | A. Nanka |
| NOR-29 | Forest resource data | P.J. Golec (Project leader) | V.S. Kolabinski |
| NOR-53 | Computer and data processing | W. Chow (Project leader) | |
| | Scientific programmer analyst | A.W. Irwin (vacant) | |
| | Computer operator | | J. Demers |
| | **FOREST PROTECTION** (H.J. JOHNSON) | | |
| NOR-1 | Detection and appraisal of tree pests and vegetative disturbances | Dr. B.H. Moody (Project leader)<br>Dr. H.F. Cerezke<br>Dr. H.R. Wong | F.J. Emond<br>H.S. Gates<br>M.G. Grandmaison<br>J. Petty<br>G.N. Still<br>D.L. Szlabey<br>R.C. Tidsbury |
| NOR-9 | Insect and disease management systems | W.G.H. Ives (Project leader)<br>J.A. Muldrew | J.A. Drouin<br>C.L. Rentz |
| NOR-35 | Tree disease research | Dr. Y. Hiratsuka | P.J. Maruyama |
| | **REGIONAL DEVELOPMENT** (Dr. M.J. HEIT) | | |
| NOR-3 | Resource opportunities and policy guidelines | D.M. Boylen (Project leader)<br>W.J. Ondro<br>T.B. Williamson | R.A. Bohning<br>H.M. Stewart |
| NOR-36 | Forest resource development agreements | D.M. Boylen (Project leader)<br>J.J. Farrell (Development officer, Prince Albert suboffice)<br>K. Froning (Development officer, Winnipeg suboffice)<br>Senior development officer (vacant) | J.P. De Franceschi |

| Project | Title | Professional Staff | Technical Staff |
|---|---|---|---|
| NOR-54 | Support services (regional development) | Dr. M.J. Heit (Project leader) | |
| | Finance officer | E.Y.M. Fung | |
| | Clerk-secretary (Winnipeg suboffice) | | (vacant) |
| | Clerk-secretary (Prince Albert suboffice) | | K.P. Bacon* |

**ADMINISTRATION**
(A.M. MONT)

| Position | Staff |
|---|---|
| Head, Financial Services | F. Allen |
| Senior Accounts Clerk | B.A. Ball |
| Vehicle and Accounts Clerk | J.L. Wake |
| Purchasing Officer | J.E. Hodgins |
| Purchasing Clerk | T.Y. Avenell |
| Senior Storesman | D.H. Oaks |
| Storesman | J.C. McLoughlin |
| Supervisor Office Services | E.R. de Looper |
| Registry Clerk | A.R. Fulton |
| Receptionist-Typist | T.B. Phillips |
| Word Processor Operator | E. Schiewe |
| Stenographer | S. Ratansi |
| Librarian | D.J.S. Robinson |
| Library Technician | E.M. Hopp |
| Photographer | P.S. Debnam |
| Electronics Technician | P. Bihuniak |
| Chief Engineer | (vacant) |
| Assistant Chief Engineer | H. Schoendube |
| Maintenance Engineers | F.H. Gardner |
| | A. De Costa |
| Electrician | J.P. de Deckere |
| Senior Maintenance Craftsman | S.T. Colistro |
| Maintenance Craftsman | B.A. Clinton |
| Groundskeeper | G.M. Schmidt |

*Effective April 1, 1983.

## APPENDIX C

## NORTHERN FOREST RESEARCH CENTRE EXPENDITURES 1982-83

| Program area | Person-years[1] | Salaries $000 | Operations & maintenance[2] $000 | Capital $000 | Total $000 |
|---|---|---|---|---|---|
| Directorate (includes Program Managers) | 5.0 | 238.6 | 118.1 | 4.2 | 360.9 |
| Administration | 27.0 | 702.4 | 481.2 | 118.1 | 1,301.7 |
| Environmental forestry | 32.4 | 930.8 | 213.1 | 65.8 | 1,209.7 |
| Forest resources | 38.4 | 1,180.0 | 197.4 | 96.2 | 1,473.6 |
| Forest protection[3] | 30.8 | 833.4 | 172.2 | 10.9 | 1,016.5 |
| ENFOR[4] | 1.6 | - | 336.5 | - | 336.5 |
| LRTAP[5] | - | - | 17.0 | - | 17.0 |
| Cost-sharing agreements[6] | - | - | 190.4 | - | 190.4 |
| Job creation | 2.0 | - | 81.9 | - | 81.9 |
| Total | 137.2 | 3,885.2 | 1,807.8 | 295.2 | 5,988.2 |

[1] Includes 12.3 person-years for students and 1.4 person-years for Francophones.

[2] Includes contracts; see Appendix E.

[3] Includes person-years and funding for the Regional Development program, which began March 1, 1983.

[4] ENergy from the FORest (Project NOR-34) funded by Canada Department of Energy, Mines, and Resources.

[5] Long-Range Transport of Air Pollutants (Project NOR-32) funded by Environment Canada.

[6] See Appendix D.

## APPENDIX D

## NORTHERN FOREST RESEARCH CENTRE COST-SHARED AGREEMENTS 1982-83

| Funding agency | Program | Project | Operations & maintenance $000 | R & D contracts $000 |
|---|---|---|---|---|
| Alberta Department of Energy and Renewable Resources | Container-seedling planting trials | NOR-10 (Ball) | 8.3 | - |
| | Publication on aspen-poplar decay | NOR-35 (Hiratsuka) | 14.8 | - |
| Alberta Department of Environment | Impact of air pollutants | NOR-7 (Addison) | 24.0 | - |
| Canterra Energy Ltd. | Monitoring of sour gas | NOR-7 (Addison) | 23.3 | - |
| Environment Canada, Parks Canada | Ecological land classification of Kootenay-Revelstoke-Glacier national parks | NOR-23 (Holland) | 30.0 | - |
| Indian Affairs and Northern Development Canada | Large-scale photosampling system | NOR-22 (Moore) | 25.0 | - |
| | Primary wood-using industries survey, Northwest Territories | NOR-3 (Ondro) | 5.0 | |
| Manitoba Department of the Environment | Heavy metals pollution | NOR-32 (Hogan) | 20.0 | - |
| National Research Council of Canada | Boreal peat resources in the prairies | NOR-28 (Zoltai) | 40.0 | - |
| Total | | | 190.4 | - |

## APPENDIX E

## NORTHERN FOREST RESEARCH CENTRE CONTRACTS LET OR SUPERVISED AND EXPENDITURES IN 1982-83

| Contractor | Title | Amount $ | Scientific authority |
|---|---|---|---|
| A.A. Loman & Associates Ltd.<br>4915 Vanguard Road N.W.<br>Calgary, Alberta<br>T3A 0R5 | Complete material for an information publication on aspen-poplar decay in Alberta | 12,100 | Y. Hiratsuka |
| Allan Moss & Associates<br>1334 St. Paul Street<br>Kelowna, B.C.<br>V1Y 2E1 | Determination of biomass and nutrient content in trees, ground vegetation, and soil of aspen stands in Alberta (P-205)[1] | 301,386 | L.G. Brace<br>I.K. Edwards |
| Forintek Canada Corp.<br>6620 N.W. Marine Drive<br>Vancouver, B.C.<br>V6T 1X2 | X-Ray densitometry analysis of tree rings | 3,500 | J.M. Powell |
| Fytche, R.F.<br>11011 - 122 Street<br>Edmonton, Alberta<br>T5M 0B2 | Review complex economic report for inaccuracies and validity | 1,125 | H.J. Johnson |
| Good, Vernon J.<br>7243 Blakeney Drive<br>Regina, Saskatchewan<br>S4X 2M4 | Preparation of a discussion paper and a communication plan for a proposed federal-provincial forestry development agreement in Saskatchewan | 7,875 | A.D. Kiil |
| Hueber, David<br>11214 - 72 Avenue<br>Edmonton, Alberta<br>T6G 0B5 | Process and perform total nutrient analysis of plant and soil samples | 3,370 | G.D. Hogan |

**APPENDIX E continued**

| Contractor | Title | Amount $ | Scientific authority |
|---|---|---|---|
| Kershaw, L.J.<br>51163 Range Road 204<br>Sherwood Park, Alberta<br>T8A 3K4 | Reorganization of the NoFRC vascular plant herbaruim | 3,350 | J.D. Johnson |
| MacIsaac, D.A.<br>11321 - 46 Avenue<br>Edmonton, Alberta<br>T6H 0A4 | Perform laboratory analysis on peat samples | 5,500 | S.C. Zoltai |
| Micko, Michael M.<br>5215 - 115 Street<br>Edmonton, Alberta<br>T6H 3P4 | Literature review on heat of combustion values pertaining to 10 tree species | 1,800 | T. Singh |
| Newforest Resources Inc.<br>29 East 11 Street<br>Prince Albert, Saskatchewan<br>S6V 0Z8 | Background document on potential of lands along agriculture-forest fringe | 7,473 | R.M. Waldron |
| Reid, Collins and Associates Ltd.<br>1178 West Pender Street<br>Vancouver, B.C.<br>V6F 3X4 | Worldwide lodgepole pine literature search | 15,000 | R.M. Waldron |
| Reid, R.W.<br>RR 2<br>Millet, Alberta<br>T0C 1Z0 | Preparation of a program review document for NoFRC | 7,000 | A.D. Kiil |
| Vitt, Dr. D.H.<br>8812 - 146 Street<br>Edmonton, Alberta<br>T5R 0V6 | Identification of bryophyte and sphagnum peat moss samples | 3,000 | W.D. Holland |

| Contractor | Title | Amount $ | Scientific authority |
|---|---|---|---|
| Woodland Resource Services Ltd.<br>10735 - 180 St.<br>Edmonton, Alberta<br>T5S 1G6 | Development of an integrated operation for aspen wood products and energy from biomass (P-207) | 15,081 | W.J. Ondro |

[1] Contracts with P numbers form part of the ENFOR program (Project NOR-34).

## APPENDIX F

## NORTHERN FOREST RESEARCH CENTRE PUBLICATIONS

(As of March 31, 1983)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Bella, I.E. and J.P. De Franceschi. 1982. Growth of lodgepole pine after mechanical strip thinning in Alberta: 15-year results. For. Chron. 58(3):131-135.

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Bernier, P.Y. 1982b. USA2: A revised source area simulator for small forested basins. Ph.D. thesis. University of Georgia, Athens, Georgia.

Brace, L.G. and P.J. Golec. 1982. Silviculture statistics for Canada, 1975-80. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-245.

Carlson, L.W. 1983. Guidelines for rearing containerized conifer seedlings in the prairie provinces. Rev. ed. Environ. Can., Can. For. Serv., North For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-214E.

Cerezke, H.F. 1982. Insects and diseases: present status and what must be done to meet Saskatchewan's potential. Pages 108-125 *in* Forest congress '82: the Saskatchewan potential, held June 1-3, 1982, in Prince Albert, Sask. Saskatchewan Forestry Association, Prince Albert, Sask.

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Ives, W.G.H., J.A. Muldrew, and R.M. Smith. 1982. Experimental aerial application of forest tent caterpillar baculovirus. Environ. Can., Can. For. Serv., North. For. Res. Cent. Edmonton, Alberta. Inf. Rep. NOR-X-240.

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POOR

QUALITY

ORIGINAL